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CENTRAL FAX CENTER

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Serial No.: 10/722,404  
Filing Date: 11/28/2003  
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Group Art Unit: 1753

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Amendments to the Specification:

Please add the following new paragraph and heading at page 1, line 2:

--This is a continuation of Application Serial No. 09/857,880, filed on June 12, 2001, now abandoned.

BACKGROUND OF THE INVENTION -

Please add the following new paragraph at page 2, line 11:  
BRIEF SUMMARY OF THE INVENTION.

Please add the following new paragraph at page 4, line 19:  
BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS.

Please replace the paragraph beginning at page 4, line 30, with "Figure 3" with the following amended paragraph:

Figure 3 shows a sectional view on the line 3-3 of **figure** Figure 2.

Please add the following new paragraph at page 5, line 1:  
DETAILED DESCRIPTION OF THE INVENTION.

Please replace the paragraph beginning at page 5, line 1, with "Referring to figure 1" with the following amended paragraph:

Referring to **figure** FIG. 1 an irradiator 10 incorporates a stainless-steel duct 12 of internal diameter 0.31 m and of wall thickness 2 mm. To the outside of the wall are attached sixty transducer modules 14 closely packed in a square array. Each

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transducer module 14 comprises a 50 W piezoelectric transducer 16 which resonates at 20 kHz, attached to a conically flared titanium coupling block 18 by which it is connected to the wall, the wider end of each block being of diameter 63 mm. The transducers modules 14 are arranged in five circumferential rings each of twelve modules 14, the centres of the coupling blocks 18 being on a square pitch of 82 mm. The irradiator 10 also incorporates five signal generators 20 (only one is shown) each of which drives all the transducers 16 in a ring. All the transducers 16 are activated at 20 kHz.

Please replace the two paragraphs beginning at page 6, line 8, with "Referring now to figures 2 and 3" and ending on page 7, line 13, with the following amended paragraphs:

Referring now to ~~figures~~ FIGS. 2 and 3 there is shown an alternative irradiator 30 which has many features in common with that of ~~figure~~ FIG. 1. The irradiator 30 includes a generally cylindrical duct 32 of polytetrafluoroethylene (PTFE) of internal diameter 0.31 m and of wall thickness 3 mm, which tapers at each end down to an internal diameter of 0.10 m and a wall thickness of 6 mm provided with a flange 33 for connection to other process ducts (not shown), and has a sealed joint 34 for inspection or cleaning purposes. Around the outside of the duct 32 is a concentric stainless-steel steel tube 35 of wall thickness 1 mm and of external diameter 0.354 m, such that there is a gap 36 of width 18 mm between the duct 32 and the tube 35. Sixty transducer modules 14 are attached to the outer surface of the tube 35 in a rectangular array forming five rings of twelve, the spacing between the ~~centres~~ centers of the coupling blocks 18 being 82 mm parallel to the longitudinal axis of the tube 35 and 92.7 mm circumferentially. The array of transducers 14 is

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enclosed by an acoustic shield 38. A coupling liquid such as olive oil 40 is used to fill the gap 36 and is re-circulated from a reservoir 42 by a pump 44. This coupling liquid has a higher threshold for cavitation than water, and has an impedance which is between that of the titanium coupling block 18 and that of the fluid within the duct 32 (typically mainly water, or an industrial solvent); at a frequency of 20 kHz the wavelength of the sound in this oil is 72 mm, so that the gap 36 is of width equal to a quarter of the wavelength.

In use of the irradiator 30, a liquid is caused to flow through the duct 32 and each transducer 16 is activated by a power supply (not shown) at 20 kHz. The dissipated power intensity and power density are as described in relation to **figure FIG. 1**. The impedance matching provided by the oil in the gap 36 allows more of the applied power to enter the fluid within the duct 32 while reducing erosion at the inner, irradiating, surface of the tube 35.